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(54) Pump with double-effect valve

(57) A pump (10) with a double-effect valve, especially a vibration type valve with oscillating plunger or piston (20) from ferromagnetic material, included in a container (12) circumscribed by a bobbin (14) with the related bushings (16) and magnetic spacer (18), cooperating with a first valve (22) abutting along the delivery duct obtained in the hollow front body (28), and with a second valve (24) located along the suction duct (48), said first (22) and said second valves (24) being spaced out by a mobile spacer or lid (26), and said second valve (24) being so located as to strike on the upper part said spacer (26) and in the lower part the upper mouth of piston (20).

FIG. 1

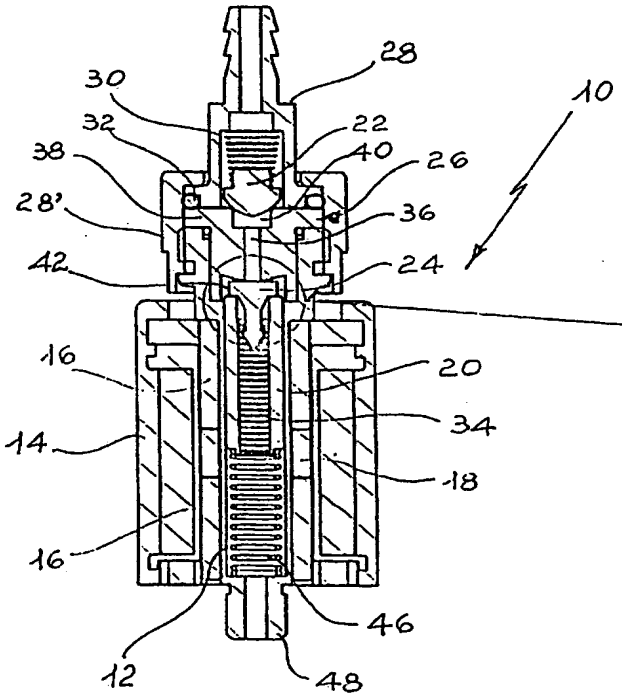
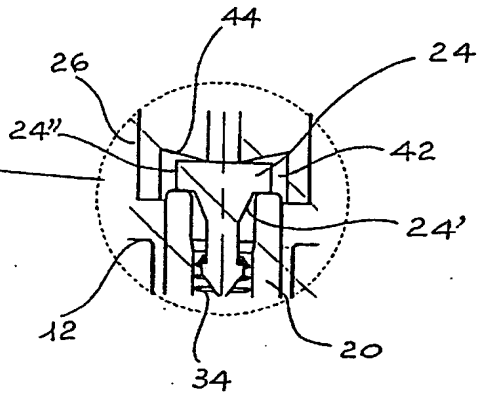


FIG. 2



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Description

[0001] The present invention relates to pump with a double-effect valve.

[0002] More particularly, the present invention relates to a pump with a double-effect valve, especially of the vibration type, i.e. an oscillating piston hydraulic electromagnetic pump.

[0003] Such types of pumps are utilized for handling fluids, typically water, and are applied, for instance, in white goods, such as irons and electric coffee machines, or in irrigation plants and in the motor car sector, etc.

[0004] As is known, oscillating piston pumps are provided with means for the interception of the fed fluid, located in correspondence of the suction and delivery ducts. Such interception means are constituted of two like valves, so conformed as to intercept in alternation the orifices of said ducts.

[0005] This solution involves a serious drawback concerning the unsatisfactory interception of the fluid in specific conditions. In fact, when the pump is not electrically fed and the fluid vein in the suction duct shows a pressure higher than that of the fluid vein in the delivery duct, an undesired blow-by or drippings take place that alter the functionality of the apparatus or the plant which the pump is applied to.

[0006] Both valves used for the aforesaid pumps are generally elastically tensioned by a spring, so that it would be theoretically possible to utilize oversized elastic means to solve the problem, especially with regard to the valve that seals the suction duct.

[0007] However, such a kind of solution would bring about the necessity of utilizing a correspondingly sized bobbin, i.e. a big bobbin, with an ensuing increase in the consumption of electric energy, as well as in the overall dimensions of the pump and the production costs.

[0008] The drawback due to blow-by can take place also in conditions of theoretical balance of the pressure of both fluid veins in the suction duct and the delivery duct, because of possible, even if temporary, abnormal situations of the mains pressure of the apparatus or plant comprising the pump.

[0009] Object of the present invention is to obviate the aforesaid drawback.

[0010] More particularly, object of the present invention is to provide a pump with a double-effect valve, especially, however not critically, of the vibration type, suitable to ensure the actual interception of the work fluid in any conditions, i.e., also if said pump is not electrically fed, in the absence of balance of the pressure of the suction and delivery fluid veins, and also in the presence of temporary abnormal mains pressures.

[0011] A further object of the present invention is to provide a pump with a double-effect valve, suitable to prevent the use of oversized elastic means for the tensioning of said valve, and therefore such as to allow the utilization of a compact bobbin, with a limited energy consumption.

[0012] A further object of the present invention is to provide a pump with a double-effect valve that allows to substantially limit its overall dimensions and the related costs.

[0013] Still a further object of the present invention is to provide a pump with a double-effect valve that ensures a high level of resistance and reliability in the time, and also such as to be easily and economically realizable. These and still other objects are achieved by the pump with the double-effect valve, especially an oscillating piston hydraulic electromagnetic pump from ferromagnetic material, included in a container circumscribed by a bobbin with the related bushings and the spacer, cooperating with a first valve located along the delivery duct obtained in the hollow front body and a second valve located along the suction duct and opposite with respect to the first one, wherein said first and said second valves are spaced out by a movable spacer or lid, and said second valve strikes on the upper part said spacer and the bottom part the upper mouth of the piston.

[0014] The construction and functional characteristics of the pump with the double-effect valve of the present invention will be better understood thanks to the following description, wherein reference is made to the attached drawings which show an embodiment solely reported by way of non limiting example, and wherein:

Figure 1 shows the schematic view of a partial longitudinal section of a pump of the vibration type with the double-effect valve according to the present invention;
Figure 2 shows the schematic view of an enlarged detail of said valve according to the embodiment of the preceding figure;
Figure 3 shows the exploded schematic view of the pump with the double-effect valve according to the present invention.

[0015] With reference to the aforesaid figures, the pump with the double-effect valve of the present invention, indicated as a whole by 10 and, by ways of example, of the vibration type, comprises: a container 12, circumscribed by a bobbin 14 with the related magnetic bushings 16 and the spacer 18, and a fluid delivery plunger or piston 20 sliding in said container 12, cooperating with a first valve 22 and a second valve 24, opposed to each other and spaced out by a spacer 26. According to the embodiment shown by way of example in the figures, the first valve 22, of a known type, is located between said spacer 26 and the hollow front body 28 of valve 10, forming the fluid delivery means. Said first valve 22 is elastically supported by a helical spring 30. Between spacer 26 and body 28, where a locking ring nut 28' is fitted on, a sealing gasket is advantageously located, constituted, for instance, by an anchor ring 32.

[0016] According to the present invention, the second

valve 24, located upstream of the first one along the suction duct, is constituted of a body, circular by way of example, with a pointed front profile. In the central-rear zone, said second valve 24 expands forming two adjoining sectors 24', 24", having different and progressively increasing diameters. Said second valve 24 is advantageously housed in correspondence of the upper end of piston 20, formed by a hollow cylindrical body from ferromagnetic material. In particular, the pointed front end of the second valve 24 abuts at least partly in the upper mouth of said piston 20 and engages with a return spring 34, hooked with known means in said piston in correspondence of its lower part.

[0017] As said above, the central-rear expanded zone of the second valve 24 is formed by said differentiated diameter sectors 24', 24". Sector 24" having a greater diameter is intended for engaging with the upper mouth of plunger or piston 20 and with the base of spacer 26, and forms a movable lid suitable to circumscribe in the upper part container 12.

[0018] Spacer 26, from metal or other suitable material, is constituted of a circular plan core provided with an axial hole 36 that has, in the upper part, a greater diameter, and forms a plate 38. On the upper base of said plate 38, a lowering 40 is obtained, aligned with hole 36, that defines the striking sealing seat of the first valve 22, which can be of any known type, but which is preferably mushroom-shaped. Said first valve 22, supported by spring 30, is located in the hollow front body 28 of pump 10. The lower front of spacer or lid 26 has, in a central position and on line with lowering 40, a shaped recessing 42, suitable to house the second valve 24 and, in particular, sector 24" with a greater diameter of the same. Said sector 24" has a disc-like configuration, with a diameter preferably slightly shorter than the external diameter of plunger or piston 20, and connects with the front part of the valve through the integral sector 24' that has a substantially truncated conic conformation. The intermediate sector 24' does not expand until it reaches the edge of sector 24", so that the lower front of the latter defines peripherally a circular crown suitable to strike the upper mouth of piston 20.

[0019] The circular plan shaped recessing 42 has a diameter greater than that of sector 24" of the second valve 24. The base of said recessing 42 obtained in spacer 26, indicated by 44 in Figure 2, is markedly convex.

[0020] In body 12, in alignment with spring 34 and below the same, a further spring 46 is located that strikes the base of piston 20 on a side and the internal front of the suckion duct 48 of valve 10 on the opposite side.

[0021] During the working, when bobbin 14 is activated that is located outside body 12 and surrounds it almost entirely, plunger or piston 20 shifts axially to a limited extent, in order to allow the passage of the fluid coming from the suction duct 48. Said piston, in particular, shifts from a first end position, the one shown in Figures 1 and 2, to a second and slightly receded position it takes on overcoming the resistance of spring 46 following the impulse determined by bobbin 14.

[0022] The slight compression of spring 46, determined by the recessing of plunger or piston 20, allows the passage of the fluid into pump 10, with a known method. The second valve 24, once piston 20 has recessed, causes the flow of the fluid that reaches recessing 42 and the overlying hole 36 obtained in spacer 26, while the first and overlying valve 22 strikes and closes the sealing seat formed by lowering 40 obtained on the same spacer, in a position opposite to said recessing 42. The directly following step, that repeats at each cycle due to bobbin 14, determines the return to the original position of plunger or piston 20 and the simultaneous opening of the first valve 22 under the effect of the pressure of the fluid present in hole 36 flowing into recessing 40.

[0023] In this step, spring 30 of the first valve 22 is slightly compressed.

[0024] Both during the activation of pump 10, when plunger or piston 20 has not recessed, but especially at the time when said pump is not electrically fed, the second valve 24 ensures the complete interception of the fluid, preventing an undesired blow-by that might take place if the fluid vein, upon suction, i.e., starting from duct 48, should have a pressure higher than that of the opposed vein, upon delivery. Said valve, in fact, advantageously realizes a double sealing effect, the first of which is determined by the convex base 44 of recessing 42, that compresses from above plate 38 of said valve. The further effect of sealing or interception of the fluid is obtained on the opposite front of said plate, along the circular crown that strikes the upper mouth of plunger or piston 20.

[0025] Because of this conformation and arrangement of the second valve 24, the sealing or interception of the fluid vein is ensured and the sealing is the more effective the greater is the positive difference between the suction pressure and the delivery pressure.

[0026] As can be inferred from the above description, the advantages achieved by the invention are obvious.

[0027] In pump 10 of the present invention, the second valve 24 ensures the actual interception of the fluid in any situation, also in the absence of electric feeding or in the presence of an abnormal mains pressure. Besides, the particular conformation of said second valve avoids the necessity of having recourse to oversized springs or elastic means to tension plunger or piston 20, with the advantageous result of having the possibility of utilizing a limited energy consumption bobbin and to contain markedly the overall dimensions of pump 10.

[0028] While the present invention has been described above with reference to a specific embodiment solely reported by way of non limiting example, it is obvious that many alternatives and variants will be apparent to those skilled in the art in the light of the above description.

[0029] So, for instance, also the first valve 22 can

have, with the suitable sizing of hole 36, a configuration similar or identical to that of the second valve 24, with the addition of a possible convex pressing means located in correspondence of its upper front and interacting with spring 30. Besides, the sliding seat of piston 20 obtained in body 12 and/or the lateral surface of said piston may be submitted to an anti-adhesion surface treatment, for instance, nickel- and teflon-based, to avoid any possible abnormal friction and to prevent the formation of eddy currents in the inside of pump 10, caused by the different electrochemical potential existing between said pump and said piston.

[0030] Therefore, the present invention intends to encompass all of the alternatives and variants that fall within the spirit and the protection scope of the following claims.

Claims

1. A pump (10) with a double effect valve, especially a pump of the vibration type with an oscillating plunger or piston (20) from ferromagnetic material, located in a container body (12) circumscribed by a bobbin (14) with the related magnetic bushings (16) and spacer (18), cooperating with a first valve (22) abutting along the delivery duct obtained in the hollow front body (28) and a second valve (24) located along the suction duct (48), **characterized in that** said first (22) and said second (24) valves are spaced out by a mobile spacer or lid (26), and **in that** said second valve (24) strikes at the top said spacer (26), and at the bottom the upper mouth of piston (20).

2. The pump according to claim 1, **characterized in that** valves (22, 24) are aligned with a through-hole (36) for the passage of the fluid, obtained in spacer (26), at whose opposite ends seats (40, 42) for the positioning and/or striking of said valves are obtained.

3. The pump according to claim 1 or 2, **characterized in that** the second valve (24) is constituted of a circular plan body, with a pointed front end and an expanded central-rear part to form two adjoining sectors (24', 24") having a progressively increasing diameter, said front end of valve (24) abutting at least partly into the upper mouth of piston (20) and being engaged with a spring (34) hooked in said piston.

4. The pump according to any of the preceding claims, **characterized in that** the lower front of spacer (26) has in the middle a shaped recessing that forms seat (42) wherein sector (24") having a greater diameter of the second valve (24) abuts, said sector having a disc-like configuration.

5. The pump according to any of the preceding claims, **characterized in that** the base of the shaped seat or recessing (42) is defined by a convex surface (44) that strikes the upper front of sector (24") of the second valve (24).

6. The pump according to any of the preceding claims, **characterized in that** the second valve (24) has, on the lower front opposite to the one stricken by the convex surface (44) of the shaped recessing (42) an annular crown that strikes the upper mouth of piston (20).

7. The pump according to any of the preceding claims, **characterized in that** it has, in alignment with spring (34) located in piston (20), a further spring (46) located in the lower part of body (12) and cooperating with said piston.

8. The pump according to any of the preceding claims, **characterized in that** the first valve (22) is mushroom-shaped and is elastically supported in the delivery duct (28) by a spring (30). The front part of said first valve striking seat (40) obtained in the upper front of spacer (26).

9. The pump according to any of the preceding claims, **characterized in that** between spacer (26) and the front hollow body (28) a sealing gasket or anchor ring (32) is located.

10. The pump according to any of the preceding claims, **characterized in that** the sliding seat of piston (20) and/or the piston have an anti-adhesion surface.

FIG. 2

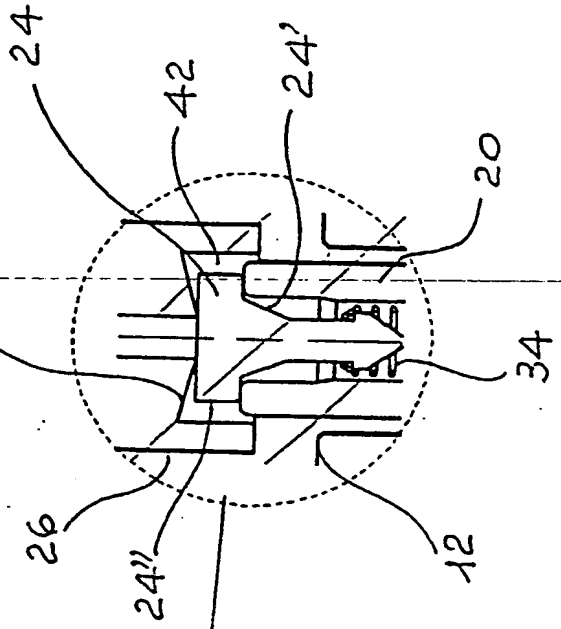
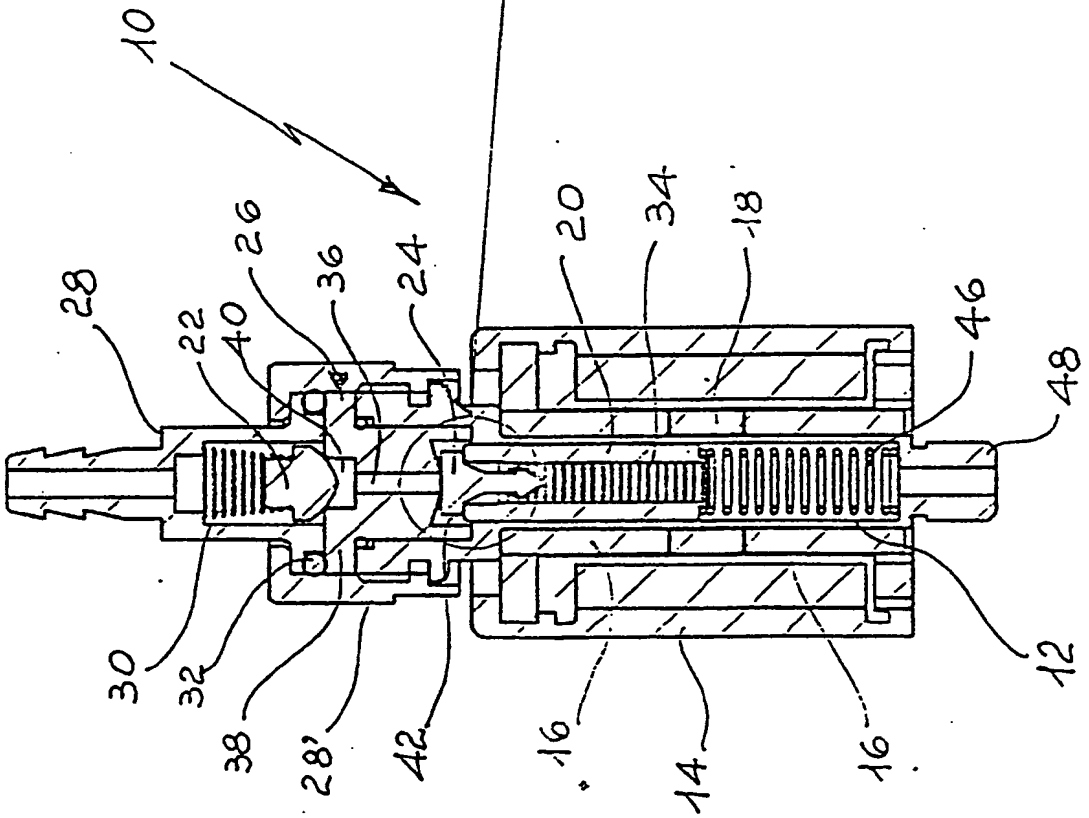


FIG. 1



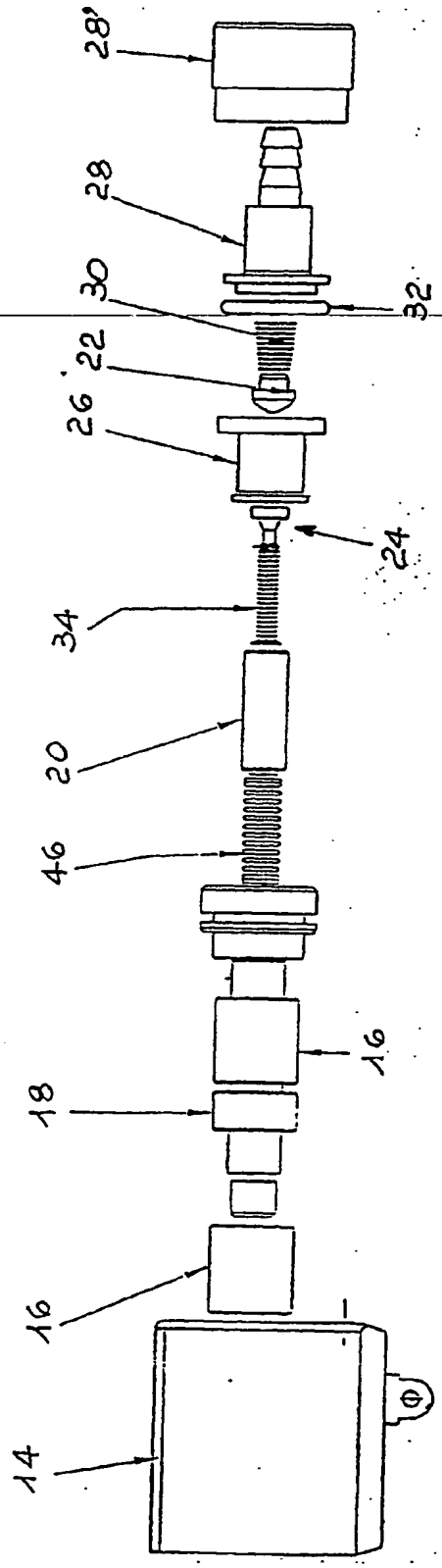


FIG. 3

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EUROPEAN SEARCH REPORT

Application Number
EP 01 12 6094

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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F04B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 February 2002	Ingelbrecht, P

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